

PALEOBOTANY.—*Notes on the Pleistocene of Maryland.*¹ EDWARD W. BERRY, Johns Hopkins University.

The idea that the Pleistocene deposits south of the terminal moraine were due to changes in relative level of land and water and were to be interpreted by their topographic height and form we owe to Shattuck, who, after setting forth his hypothesis in several earlier papers, gave it its final form in 1906 in the volume discussing the Pliocene and Pleistocene deposits of Maryland. Shattuck was a brilliant worker, but not a sustained and persevering detailist. Having published his interpretation he apparently lost interest in it and never during the rest of his life returned to the subject. It was, however, adopted by a number of younger men and extended throughout the remainder of the Atlantic and Gulf Coastal Plain. There have always been physiographers who have been violently critical, although on the whole I think it is fair to say that Shattuck's interpretation, with, of course, modifications of detail, has been generally accepted by geologists. One of the difficulties for many minds has been the problem of visualizing a complex series of events in terms of a rather rigid scheme of changes of level, or of differentiating the episodes in an actual exposure from the final event that controlled the surviving topographic form. There was, too, the difficulty in many minds of visualizing the marine control, which changes of level exercised in stream valleys even though the sediments were not actually marine and did not contain marine fossils. The time involved is inconsiderable as geologic time is reckoned and such fossils as have been found, either animal or plant, have in consequence had but slight if any stratigraphic value, and reflect shifting environments and changing geographical distribution among groups of organisms whose specificity was, for the most part, unchanged throughout the whole interval from early Pleistocene to modern times.

It is not my purpose to attempt a history of opinion of the Coastal Plain terrace formations or to discuss them formally within even the limits of Maryland, and the foregoing remarks are made as introductory to a consideration of certain local observations.

Dr. C. W. Cooke, who has written considerable on the Coastal Plain terrace formations, advocates a revised terminology for the younger ones² and proposes that the name Talbot terrace, which derives from Talbot County on the Eastern Shore, be retained for the

¹ Received October 4, 1940.

² COOKE, C. W. *Journ. Washington Acad. Sci.* 21: 503-513. 1931.

42-foot level and that for a younger Talbot stage observed in some places in Maryland the name Pamlico be extended from North Carolina, where this stage is beautifully developed. The Pamlico has an altitude of about 25 feet and has been recognized in Prince Georges County and the District of Columbia at both of which it has furnished a considerable flora.³ C. K. Wentworth⁴ recognized a still lower level in Virginia for which he proposed the name Princess Anne, which has an altitude of about 12 feet. Cooke dissents from this proposal of Wentworth's. If accepted, both the Airport deposits and those at Wagners Point, which are discussed in the following pages, would be referred to the Princess Anne stage of the late Pleistocene, although it is possible, but not demonstrable, that traces of older Pleistocene deposits are shown in the test borings at the Airport.

MUNICIPAL AIRPORT

Through the cooperation and intelligent interest of W. Watters Pagon, consulting engineer on the Baltimore Airport, I am indebted for samples and for the records of a series of test borings. The former have furnished a few identifiable plants from the deposits and the latter some interesting data on changing conditions and less clear indications of past changes of level. They show, for one thing, considerable erosion in the Cretaceous surface previous to the deposition of the Pleistocene. At the Airport the Cretaceous is encountered about 60 feet below tide, whereas on the opposite shore of the Patapsco and a couple of miles down the dip near Hawkins Point the Cretaceous rises to a height of 24 to 28 feet above tide.

The borings show also considerable thicknesses of carbonaceous clays with plant remains, possibly marsh deposits, separated by two or three intervals of coarser water laid and presumably stream deposits. These might be interpreted as due to alternating times of elevation and depression and as referable to different-named stages in the Pleistocene, but since exact lithological correlations are impossible between adjacent borings I am inclined to think that the major factor is shifting conditions—what might be called “scour and fill”—rather than changes in level, although minor changes must inevitably have occurred.

The plants found in the clays (mud) include (1) badly decayed dicotyledonous wood, otherwise unidentifiable; (2) leaf fragments and an

³ BROWN, R. W. *op. cit.* and BERRY, E. W. *Journ. Washington Acad. Sci.* 23: 1-25. 1933.

⁴ WENTWORTH, C. K. *Virginia Geol. Survey Bull.* 32. 1930.

acorn cupule of *Quercus* sp.; (3) a seed and numerous leaf fragments of *Fagus americana*.

WAGNERS POINT

On the south bank of the Patapsco between Wagners and Fishing Points, directly across from the Airport, the land surface is only a few feet above tide. Excavations for a WPA sewer project have thrown out a large amount of material. Its lithologic similarity to that encountered in the borings at the Airport led to its careful examination, although no information was obtainable as to its stratigraphic relations. Considerably more identifiable plants were found in these deposits. The material is a very silty uncompact dark grayish, often very micaceous clay, with scattered quartz pebbles, full of leaf fragments mostly very much broken and thoroughly macerated. Obviously stream lain and apparently in a backwash or eddy on a tidal flat. An occasional seed, small broken sticks and fragments of bark, pieces of acorns or cupules, husks and nuts of a hickory, etc.

I have seen innumerable cove beaches in the estuaries around Chesapeake Bay where the material is of the same silty texture and where at low tide one observes fragments of oak or similar coriaceous leaves, occasional sticks or hard fruits and pine cones that seem to me to duplicate the conditions during the Pleistocene in this general region. This is especially true of the sediments as well as the plant contents in the material from Wagners Point.

The plant material consists of the following:

Pinus virginiana (Mill.) A single small cone-scale. This is still a common species hereabouts and according to Chrysler forms both pure stands and mixed pine-oak associations in southern Maryland. In its wider range it extends from Long Island, N. Y., to South Carolina in the Coastal Plain. It has not previously been found fossil.

Taxodium distichum (L.) L. C. Rich. The bald cypress is found in the Coastal Plain Pleistocene at innumerable localities from New Jersey to Florida and Louisiana. These are usually of Talbot or Pamlico age, but some very large stumps were encountered in excavating for the Mayflower Hotel in Washington,⁵ which are referred to the Wicomico formation. It is present in the clays at Wagners Point by detached leaves, which are very characteristic when first collected. At the present time the bald cypress reaches its northern limit in southern Charles County, but during the Pleistocene it ranged northward as far as New Jersey and in this latitude it ranged inland to the Fall Line, or even beyond.

Hicoria ovata (Mill.) Britton. A single nut and many nearly complete sections of the very thick husks. In general this is now a rich soil species ranging from Canada to western Florida, Alabama, and Mississippi. Accord-

⁵ BERRY, E. W. Journ. Washington Acad. Sci. 14: 15, pl. 1, figs. 37-42, pl. 3. 1924.

ing to Chrysler it is frequent in what he calls Oak-Hickory association in southern Maryland. *Hicoria ovata* has a large number of Pleistocene records including Pennsylvania, Maryland, District of Columbia, and North Carolina. It occurs in deposits correlated with the Pamlico formation both in the District of Columbia and Prince Georges County, Md.

Alnus rugosa (Du Roi) K. Koch. A leaf. The alder is common on wet soil in Maryland, ranging northward to Maine and southward to Florida and Texas. *Alnus rugosa* has been recorded from the Talbot of Drum Point, Md., and the Pamlico of the District of Columbia.

Fagus americana Sweet. Many leaf fragments and an immature fruit. The beech is widespread in the Coastal Plain Pleistocene from Pennsylvania to Texas. Its modern range is from Ontario to Florida, and it is not uncommon in tidewater Maryland.

Quercus sp. Small fragments of bristle-tipped lobes of oak leaves are rather common. They are too incomplete for specific determination but represent *rubra*, *velutina*, or *digitata*. The first of these has been recorded from the Pamlico of Prince Georges County.

Vitis cf. *cordifolia* Michaux. A single characteristic seed, probably of this species. Grape seeds are common in the Coastal Plain Pleistocene from New Jersey to Louisiana and are widespread in the Talbot of Maryland.

OSTREA VIRGINICA IN THE COLGATE DISTRICT OF EAST BALTIMORE

An interesting specimen is a large fragment of "coquina" made up of fragments of the common *Ostrea virginica* collected at the borrow pit from which the City of Baltimore is taking fill for the Municipal Airport. The specimen was turned over to the consulting engineer by a workman, and the approximate depth was 8 or 9 feet below the surface at the base of the gravels, which are supposed to be of Sunderland age and close to the contact with the underlying Upper Cretaceous. The altitude is about 100 feet. The location is at the corner of the proposed extensions of Boston Street and the Broening Highway.

There are a number of considerations that can not now be verified before the authenticity of the find can be accepted. If we assume that it was collected in place, the oyster bed should be more extensive. Oyster spat would hardly set and grow to maturity in a rapidly forming gravel deposit. It might be concluded that the pieces were torn from a contemporaneous oyster bed and deposited with the gravel. The depth at which the specimen was found precludes its having come from a refuse dump of some oyster cannery or old shell road or Indian kitchen midden. The last would hardly be likely to occur at a distance from the present shores; an old road fragment would hardly be so cleanly washed.

If the specimens are actually indigenous in the Sunderland it is the first record of marine or estuarine fossils in any of the Maryland terrace formations older than the Talbot. *Ostrea virginica* occurs abun-

dantly in the Talbot of Calvert, St. Marys, Talbot, and Caroline Counties, Maryland. The present record is much more remote from modern marine waters and, if authentic, goes a long way toward substantiating the accepted theory of the marine origin of the Pleistocene terrace deposits.

WHITE OAK FROM BED OF CARDIFF AVENUE

I am indebted to W. W. Pagon for a specimen of a small stump of some species of the white-oak section of *Quercus* collected from the bed of Cardiff Avenue, 250 feet east of the Broening Highway. This was found 12 feet below the present surface and may be of Wicomico age. The specimen is of the extreme base of a stump and is about $8\frac{1}{2}$ inches high, worn to a pointed top and rotted to a hollow on the under side.

Anatomical features afford no satisfactory basis for differentiating species among the white oaks. Of the recent species of white oaks in the Coastal Plain of this latitude *Quercus alba* occurs abundantly in the Pleistocene from the Interglacial of Canada (Don River) to North Carolina and Tennessee. In Maryland it is found in the Sunderland of Calvert County and the Pamlico of Prince Georges County; *Quercus lyrata* occurs in the Pleistocene of North Carolina, Louisiana, and Texas.

HEMLOCK FROM BRIGHTSEAT, PRINCE GEORGES COUNTY

Perfectly characteristic cones of *Tsuga canadensis* (L.) Carriere were collected by Dr. Charles T. Berry from the Pleistocene overlying the Monmouth Upper Cretaceous at the well-known Monmouth fossiliferous exposure near Brightseat, Prince Georges County.

Previous fossil records of hemlock are from peat deposits in southeastern Canada⁶ and from Pamlico deposits along Northwest Branch Anacostia River in Prince Georges County, Md., where both wood and cones have been found.⁷

In the modern flora this tree is found from Nova Scotia to eastern Minnesota, southward to northern Delaware and along the Appalachians to northwestern Alabama (Sargent). In Maryland it is known naturally from but a single locality in the Coastal Plain (Watts Creek, Caroline County) (Chrysler), a doubtful record; it is sparing in the Lower Midland Zone (Shreve), frequent in the Upper Midland Zone (Blodgett), and abundant in the Mountain Zone (Shreve).

⁶ AUER, V. Geol. Surv. Canada Mem. 162: 32. 1930.

⁷ BROWN, R. W. Journ. Washington Acad. Sci. 25: 443. 1935.